Moorhead I-94 and 20th Street Interchange Analysis

Prepared for:
Fargo-Moorhead Metro COG

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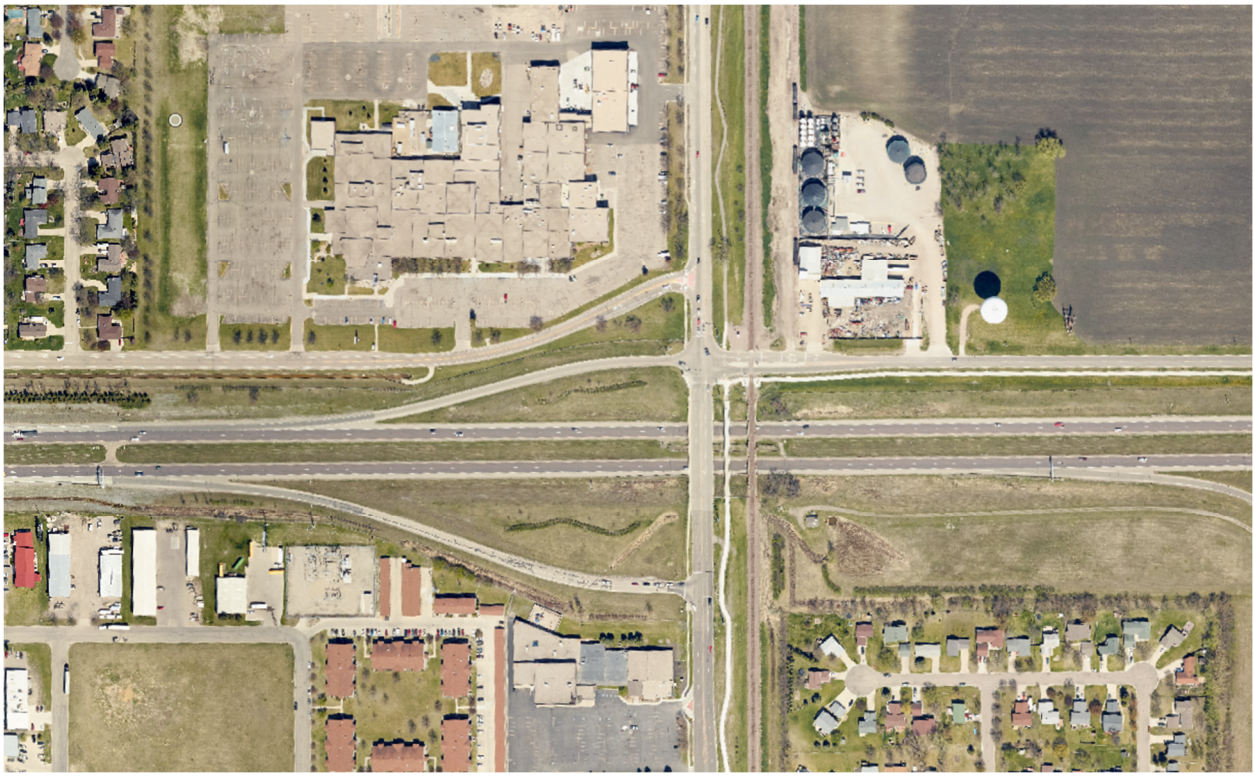

Stantec Consulting Services Inc.

Disclaimer

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1 Introduction

1.1 Project Background

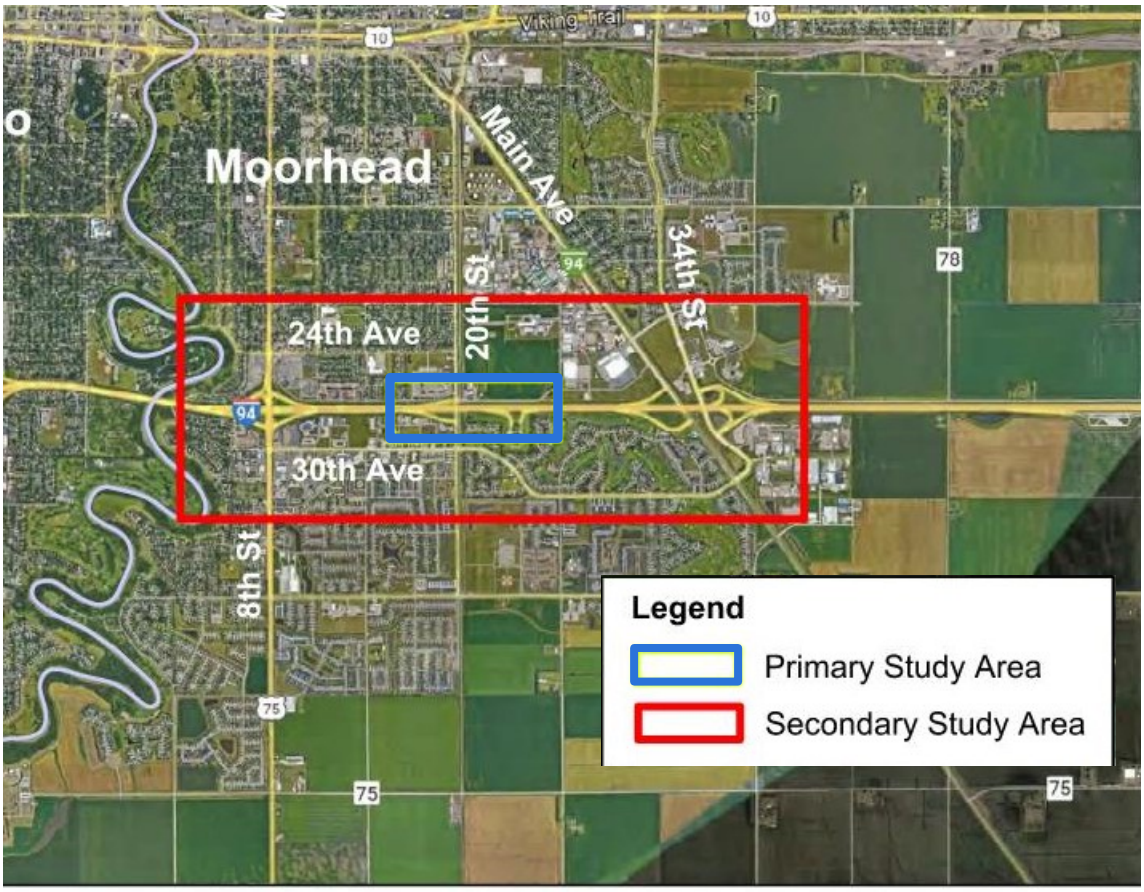
The interchange of Interstate 94 (I-94) with 20th Street/MSAS 126 is a half diamond interchange located in the City of Moorhead, Clay County, Minnesota. I-94 is an Interstate freeway running east and west through Moorhead, connecting Fargo and other North Dakota cities to cities through central Minnesota including the Twin Cities metropolitan area. 20th Street is a minor arterial running north and south through Moorhead and is one of the primary routes connecting I-94 to Moorhead's central business district and residential communities south and north of I-94. Currently, the interchange only serves trips to and from the west via a westbound on-ramp and east-bound off-ramp. Trips to and from the east can only be served at adjacent interchanges such as U.S. Highway 75 (US 75)/8th Street and 34th Street.

The Fargo-Moorhead Metropolitan Council of Governments (Metro COG) initiated a study of the interchange to identify feasible alternatives to convert it into a full access interchange to alleviate potential capacity concerns at adjacent interchanges and improve connectivity within Moorhead and the region. Metro COG contracted Stantec to perform the interchange analysis to conceptualize interchange layouts and determine the preferred alternative that fulfills the needs of the interchange while remaining within site constraints.

1.2 Study Area

The primary study area for this project consists of the I-94 and 20th Street interchange including the existing ramp terminal intersections and freeway weaving segments. Due to its proximity, the Moorhead Travel Information Center/ Rest Area located off the eastbound lanes of I-94 to the east of the interchange is also included in the primary study area. A secondary study area was also included in the project and includes the adjacent interchanges of I-94 with 8th Street/ US 75, Main Avenue/ I-94 Business, and 34th Street, as well as nearby adjacent intersections and the surrounding collector and arterial roadway network. The study area and extents are shown in **Figure 1**.

Figure 1 *Primary and Secondary Study Areas*



2 Existing Conditions

The following information details the existing conditions for the study area. The Existing Conditions Memorandum along with its supporting documentation can be found in Appendix A.

2.1 Interchange Geometry

The I-94 and 20th Street interchange is a half diamond interchange with a westbound on-ramp in the northwest quadrant and an eastbound off-ramp in the southwest quadrant. From Metro COG's GIS roadway database, I-94 is classified as an interstate, 20th Street is classified as a minor arterial, and 28th Avenue (frontage road on the north side of I-94) is classified as a collector.

I-94 is a four-lane divided freeway with 12-foot through lanes, 4-foot inside shoulders, and 10-foot outside shoulders and has a speed limit of 55 mph. South of the interchange, 20th Street is briefly a four-lane undivided roadway then adds a two-way left-turn lane (TWLTL) 400 feet south of the southern ramp terminal intersection. This section has 11- and 12-foot through lanes, a 12-foot TWLTL, and curb and gutter. North of the interchange, 20th Street is a three-lane section with 12-foot through lanes, a 12-foot TWLTL, and curb and gutter. The transition from three lanes to four lanes occurs at the 20th Street overpass, with the southbound outside through lane added as a second receiving lane for the single through lane at the north ramp terminal intersection and the northbound inside through lane converting to a dedicated left turn lane after the south ramp terminal intersection. The speed limit along all of 20th Street is 30 mph. 28th Avenue is a two-lane roadway with 12-foot lanes and a speed limit of 30 mph. 20th Street has a right-of-way width of 80 feet.

The westbound on-ramp has a length of approximately 1,030 feet, a lane width of 15 feet, and a 5-foot inside shoulder. The westbound on-ramp enters I-94 as an auxiliary lane connecting through to the adjacent US 75 interchange with a marked length of approximately 2,600 feet and a lane width of 12 feet. The eastbound off-ramp has a length of approximately 1,690 feet, a lane width of 16 feet, and 4-foot shoulders. The eastbound off-ramp originates from I-94 as an auxiliary lane connecting from the adjacent US 75 interchange with a marked length of approximately 1,970 feet and a lane width of 12 feet.

The north and south ramp terminal intersections operate under signal control, with the north intersection consisting of the westbound on-ramp and 28th Avenue east of 20th

Street and the south intersection consisting of the eastbound off-ramp only. The signals are interconnected along 20th Street with the 12th Avenue and Main Avenue signals. The intersection with 28th Avenue west of 20th Street is approximately 190 feet north of the north ramp terminal intersection, operates under side-street stop control, and is right-in right-out (RIRO) only. Signal timings for the ramp terminal intersections and for the 30th Avenue intersection were provided by the City of Moorhead and will be used in initial project analyses.

There are several accesses in the vicinity of the interchange that could be impacted by the layout or construction activities should a full interchange project occur. South of the interchange on 20th Street, there are two accesses serving Triumph Lutheran Brethren Church and a doctor's office on the west side approximately 208 and 440 feet south of the south ramp terminal intersection, with the northern access being RIRO only. North of the interchange on 20th Street, there is one access serving Minnesota State Community and Technical College (M-State) on the west side approximately 640 feet north of the north ramp terminal intersection. Another access for M-State is located on the north side of 28th Avenue approximately 600 feet west of 20th Street. On 28th Avenue east of 20th Street, Ken's Sanitation and Recycling and MacroSource have three accesses located on the north side approximately 260, 500, and 560 to the east of the intersection.

The Moorhead Travel Information Center/ Rest Area is located approximately 1,600 feet east of 20th Street on the eastbound side of I-94 with the off-ramp located approximately 2,220 feet east of the 20th Street interchange eastbound off-ramp. The on-ramp exiting the rest area begins approximately 1,350 feet east of the rest area off-ramp and enters I-94 as an auxiliary lane connecting to the Main Avenue and 34th Street interchanges. The off-ramp diverge taper is 240 feet long and the weave section is marked at 5,090 feet long extending fully to the 34th Street off-ramp, with the Main Avenue ramp beginning at approximately 2,230 feet.

Figure 2 *Existing Interchange Features*

The rest area has separate loops for passenger cars and combination truck traffic leading to their designated parking areas.

2.2 Active Transportation Facilities

Pedestrian and bicycle facilities are present in the interchange area. Sidewalk is present along the west side of 20th Street between 24th Avenue and 30th Avenue. The sidewalk is five feet wide, is separated from the back of curb, and shares the bridge with 20th Street as it passes over I-94. Shared use paths are present along 20th Street between adjacent streets and along the south side of 28th Avenue east of 20th Street. The shared use paths are ten feet wide and separated from the back of curb. The shared use path along 20th Street has a dedicated bridge over I-94. 28th Avenue west of 20th Street has painted on-street bicycle lanes. Marked crosswalks are present at both ramp terminal intersections with one crossing the eastbound off-ramp at the south intersection and three crossing the westbound on-ramp, the south leg of 20th Street, and 28th Avenue at

the north intersection. These crossings have Accessible Pedestrian Signal (APS) pushbuttons and pedestrian signal phases. All pedestrian/bicycle facilities meet current standards.

Bicycle and pedestrian transportation was an important component of the 2045 Fargo-Moorhead Metropolitan Transportation plan. The transportation plan outlines the goal to create complete streets with improved traffic flow and safer pedestrian facilities. I-94 creates a barrier for active transportation users where there are limited crossing opportunities, therefore future improvements to the 20th Street interchange should maintain and enhance pedestrian and bicycle safety and connectivity within the community, especially in the vicinity of Minnesota State Community and Technical College (M-State) which may potentially generate a high number of active transportation trips.

Figure 3 *Multi-use Path and Bridge Adjacent to 20th Street*

MATBUS is the transit provider in the Fargo-Moorhead metro area and has one fixed route that enters the interchange area. Route 5 serves destinations in southern Moorhead and circles around M-State, crossing I-94 on 20th Street in both directions. The route travels eastbound on 28th Avenue and turns right onto 20th Street, serving a sheltered bus stop across from M-State approximately 560 feet west of 20th Street adjacent to the westbound on-ramp. The route runs on 30-minute headways from about 6:00 AM to 10:00 PM on weekdays and 7:00 AM to 10:00 PM on Saturdays. Local school bus routes also run through the interchange area that utilize 28th Avenue.

2.3 Intelligent Transportation Systems

There are no existing intelligent transportation systems (ITS) in the vicinity of the interchange or along I-94 through Moorhead.

2.4 Existing Bridges

There are three existing bridges within the interchange area carrying 20th Street, a multi-use path and BNSF Rail.

Figure 4 *Existing Bridges Looking West*

2.4.1 Bridge No. 14811: 20th Street (MSAS 126) over I-94

This bridge was built in 1973, is 231.5 feet long and 59 feet wide. The bridge carries four lanes of vehicle traffic and includes a raised sidewalk on the west side. The detour route length is four miles. The condition ratings from the current Structure Inventory Report are shown below. The underclearance rating of 5 is because it has less vertical clearance (16.1 feet) than the current minimum standard of 16'-6". *(Note: the condition and appraisal ratings shown below are from an inspection conducted in the fall of 2023, after the Existing Conditions Memo was completed. The 2023 inspection downgraded the substructure rating from 7 to 5, and the Structure Evaluation from 6 to 5, resulting in an overall condition rating of "Fair".)* This is tabulated in **Figure 5.**

+ NBI CONDITION RATINGS +	
Deck	7
Superstructure	8
Substructure	5
Channel	N
Culvert	N
+ NBI APPRAISAL RATINGS +	
Structure Evaluation	5
Deck Geometry	6
Underclearances	5
Waterway Adequacy	N
Approach Alignment	8

Figure 5 *Bridge No. 14811 Ratings*

2.4.2 Bridge No. 14530: Pedestrian Bridge over I-94

This bridge was built in 1995, is 232 feet long and 12.3 feet wide. The bridge carries a 10-foot wide shared-use path over I-94. The condition ratings from the current Structure Inventory Report are shown below. This bridge provides 16.8 feet of vertical clearance over I-94, slightly less than the current standard of 17'-4" for pedestrian bridges. *(Note: the condition and appraisal ratings shown below are from an inspection conducted in the fall of 2023, after the Existing Conditions Memo was completed. The 2023 inspection downgraded the deck and substructure ratings from 8 to 6, and the Structure Evaluation from 8 to 6, resulting in an overall condition rating of "Fair".)* This is tabulated in **Figure 6.**

+ NBI CONDITION RATINGS +	
Deck	6
Superstructure	8
Substructure	6
Channel	N
Culvert	N
+ NBI APPRAISAL RATINGS +	
Structure Evaluation	6
Deck Geometry	N
Underclearances	6
Waterway Adequacy	N
Approach Alignment	N

Figure 6 *Bridge No. 14530 Ratings*

2.4.3 Bridge No. 9477: Burlington Northern Santa Fe (BNSF) Railroad over I-94

This bridge was built in 1960, is 238 feet long, and 18.5 feet wide. The bridge carries the Burlington Northern Santa Fe (BNSF) East Breckenridge-South Moorhead Line single track over I-94. The condition ratings from the current Structure Inventory Report are shown below. The underclearance rating of 4 because it less vertical clearance (16.1 feet) than the current minimum standard of 16'-6". *(Note: the condition and appraisal ratings shown below are from an inspection conducted in the fall of 2023, after the Existing Conditions Memo was completed. The 2023 inspection maintained the same condition and appraisal ratings as the previous inspection and resulted in condition rating of "Fair".)* This is tabulated in **Figure 7**.

+ NBI CONDITION RATINGS +	
Deck	7
Superstructure	6
Substructure	7
Channel	N
Culvert	N
+ NBI APPRAISAL RATINGS +	
Structure Evaluation	6
Deck Geometry	N
Underclearances	4
Waterway Adequacy	N
Approach Alignment	N

Figure 7 *Bridge No. 9477 Ratings*

2.5 Utilities and Drainage

In the vicinity of the interchange, 115 kV overhead transmission power lines are present along the south side of I-94, on the south side of the eastbound off-ramp, and along the east side of 20th Street. This set of power lines connects to a sub-station adjacent to the eastbound off-ramp approximately 800 feet west of 20th Street. An additional overhead service power line runs parallel to 20th Street east of the railroad. Traffic signal hardware is present in the interchange area to service the ramp terminal intersection signals. Various underground utilities are also present in the interchange area, including power lines, communications lines (fiber optic, telephone, and cable), petroleum pipelines, a sanitary sewer line serving the Travel Information Center, and water supply lines, particularly around the westbound ramp terminal intersection in the northwest quadrant.

Figure 8 *Power Transmission Line*

Lighting is present along 20th Street consisting of luminaires with a spacing ranging from approximately 110 to 210 feet and luminaires at the ramp terminal intersections. No lighting is present immediately near the railroad or shared-use path crossings.

A water tower is located near the northeast quadrant of the interchange, east of Ken's Sanitation and Recycling.

20th Street and the overpass have an urban drainage system with curb and gutter and catch basins that flows into the interchange area and to County Ditch 30 north of I-94 and the ditch south of I-94, or to the urban storm sewer systems north and south of the interchange. Drainage along the I-94 mainline in the interchange area flows into a storm sewer system and to a lift station in the southeast quadrant of the interchange, where it flows into the south ditch. Outside the interchange area, I-94 flows into the ditches through culverts.

2.6 Freight, Emergency Services, and Railroad

I-94 is a major interstate highway that serves regional, national, and international freight truck traffic, particularly between the Midwest, western U.S., and Canadian Prairies. 20th Street serves as an unofficial harvest truck route in the fall and serves businesses with frequent heavy vehicle activity, including Ken's Sanitation and Recycling, Macrosource (formerly Gavilon Fertilizer), the former Anheuser-Busch Malt Plant, and the industrial park to the east.

Some emergency services are present in the vicinity of the interchange. The Moorhead Fire Department Southside Fire Station is located on 20th Street near the intersection with 24th Avenue. Along with other city emergency services, 20th Street is a primary route to access areas of Moorhead south of I-94. With few alternate I-94 crossings, maintenance of traffic during construction will be essential to maintain access to emergency services. Additionally, 20th Street is identified as a primary snow emergency route and thus will be prioritized in maintaining operations during snow events. A map of snow emergency routes is shown in Appendix A.

Figure 9 *28th Avenue at Grade Railroad Crossing*

An active freight railway runs parallel to 20th Street approximately 120 feet east of the centerline. The railway crosses I-94 with a dedicated bridge and crosses 28th Avenue and its adjacent shared use path with an at-grade crossing. This crossing has vehicle and pedestrian warning gates and vehicle channelization. The railway is identified as the East Breckenridge-South Moorhead Line in the Moorhead Subdivision operated by BNSF under their Twin Cities Division. An estimated eight trains use this line in a 24-hour period with a maximum speed of 60 mph at the 28th Avenue crossing. Two crashes were reported at this crossing location in the past 20 years. One crash occurred in 2005 involving a combination truck and the most recent crash occurred in 2008 involving a light pickup truck. Both crashes resulted only in property damage. Railway crossing data and crash data is shown in Appendix A.

2.7 Traffic Data

Historic average annual daily traffic (AADT) volumes within the interchange area were obtained from MnDOT's Traffic Mapping Application and are shown in **Table 1.**

Table 1 *Historic Average Annual Daily Traffic (ADDT) Volumes*

Count Location	AADT (Year)
I-94 Mainline West of Interchange Ramps	56,808 (2021)
I-94 Mainline East of Interchange Ramps	38,816 (2021)
20th Street South of Interchange Ramps	22,815 (2021)
20th Street North of Interchange Ramps	14,400 (2017)
Eastbound Off-ramp	4,367 (2021)
Westbound On-ramp	4,901 (2021)
28th Avenue East of 20th Street	8,527 (2021)
28th Avenue West of 20th Street	1,500 (2019), 980 (2020)

Turning movement counts were collected by Stantec using video collected by Metro COG for the two ramp terminal intersections of the interchange. Video was collected for 24 hours on Thursday, May 4, 2023. Counts were collected during the AM (7:00 – 9:00

AM), mid-day (11:00 AM – 1:00 PM), and PM (4:00 – 6:00 PM) in 15-minute intervals to determine the peak hour volumes of the two intersections. Counts included vehicle classes sorted by passenger cars/light duty pickup trucks, single-unit trucks, and combination trucks. Volumes were balanced between the two intersections as shown in **Figure 10**.

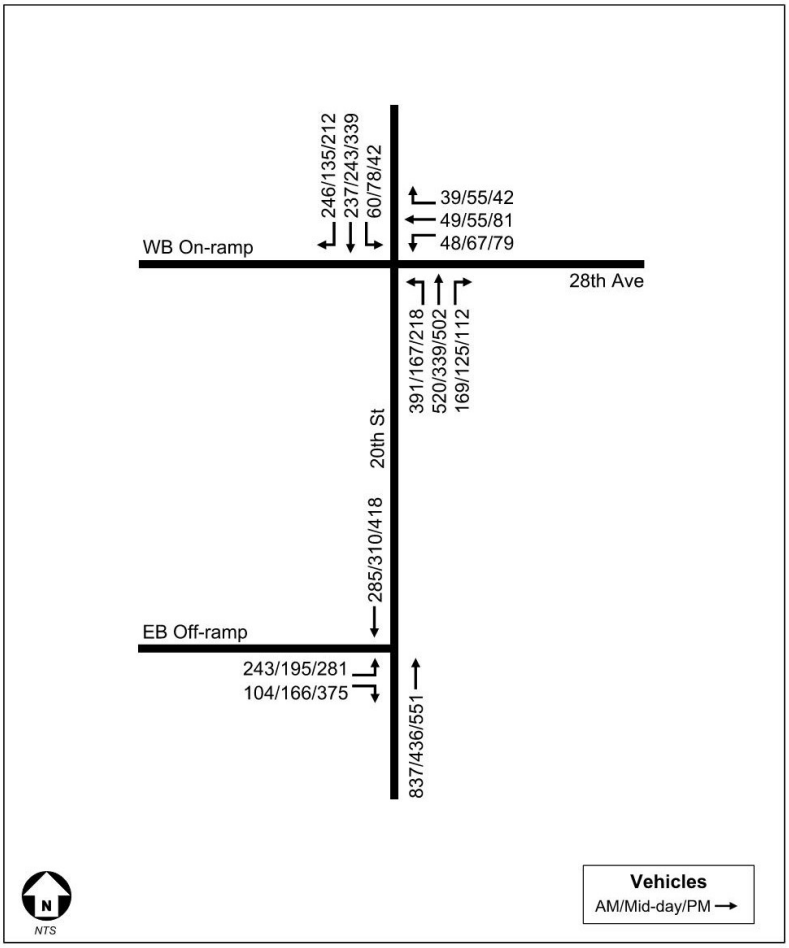


***Figure 10** Peak Hour Volumes (Balanced)*

Pedestrian and bicycle counts were also collected using the same video data. These counts were taken over 24 hours in 15-minute intervals to determine the number of pedestrians and bicycles on each side of 20th Street (on the sidewalk and shared-use path) and their direction of travel. In 24 hours, 36 pedestrians and 28 bicycles used the sidewalk on the west side of 20th Street and 29 pedestrians, and 54 bicycles used the shared-use path on the east side as shown in **Table 2**.

***Table 2** 2023 Pedestrian and Bicycle Counts*

West Sidewalk				East Shared-use Path			
Northbound ↑		Southbound ↓		Northbound ↑		Southbound ↓	
							
15	10	21	18	21	32	8	22

Peak hour turning movement counts, pedestrian and bicycle counts, and detailed raw count data is shown in Appendix A.

To estimate the 2023 AADT of the ramp terminal intersection legs listed in 3, factors were developed by comparing the 2021 AADT to peak hour turning movement counts that were collected by Metro COG on Tuesday, September 14, 2021. This calculation accounted for variability throughout the year by applying seasonal adjustment factors obtained by MnDOT of 0.93 for September and 0.97 for May. For 20th Street north of the interchange ramps, since the AADT was calculated for 2017, an additional growth factor was applied to estimate 2021 AADT at a growth rate of 0.84% per year. **Table 3** shows the estimated 2023 AADT of the ramp terminal intersection legs. Detailed AADT estimation calculations are shown in Appendix A. The significant volume difference between 2021 and 2023 estimated AADT on 20th Street north of I-94 is likely due to the 20th Street rail grade separation project completed in 2022. The slight decrease between 2021 and 2023 for the eastbound off-ramp is likely due to variation in travel or commuting patterns resulting from the later stages of the COVID-19 pandemic.

Table 3 *2023 Estimated Average Annual Daily Traffic (AADT) Volumes*

Count Location	Historic AADT (Year), ***Est.***	2023 Estimated AADT
20th Street South of Interchange	22,815 (2021)	24,810
20th Street North of Interchange	14,400 (2017), *14,900*	19,530
Eastbound Off-ramp	4,367 (2021)	4,190
Westbound On-ramp	4,901 (2021)	5,100
28th Avenue East of 20th Street	8,527 (2021)	8,750

In addition, traffic volumes entering and exiting the Travel Information Center/Rest Area were collected on Tuesday, September 14, 2021 in 15-minute intervals. The volumes show in the AM peak hour of rest area traffic 15 entering and 25 exiting vehicles with 32-33% heavy vehicles and in the PM peak hour 20 entering and 23 exiting vehicles with 13-15% heavy vehicles. Rest area raw count data is shown in Appendix A.

2.8 Crash Data

A review of the crash data for the interchange area over a five-year period from 2018 through 2022 was completed. Crash data was obtained from the MnDOT crash database using the Minnesota Crash Mapping Analysis Tool (MnCMAT2). Data was obtained for the two ramp terminal intersections and for a section of the I-94 mainline which constitutes the influence area of the interchange and rest area ramps. The mainline was divided into two segments based on AADT volumes. The first segment (west segment) begins at the start of the weave area at the US 75 east ramps 3,900 feet west of 20th Street and ends at the merge point of the 20th Street westbound on-ramp, equaling approximately 0.55 miles. The second segment (east segment) begins at the westbound on-ramp merge point and ends at the end of the weave area at the Main Avenue ramps 4,400 feet east of 20th Street, equaling approximately 1.03 miles. These segments capture weaving behavior between adjacent interchanges. While outside the primary study area, due to its proximity, the RIRO intersection of 28th Street west of 20th Street was also examined for crashes, but no crashes were reported there between 2018 and 2022.

Crashes were reviewed for accuracy, which included verifying the crash type, vehicle directions, and relation to intersections and segments. A summary of reported crashes is provided in **Table 4** and discussed in more detail below. MnDOT crash data and a map of the segments and crashes are included in Appendix A.

Between 2018 and 2022, there were no reported pedestrian or bicycle related crashes in the vicinity of the interchange. It is important to note that it can be difficult to identify crash trends for transportation modes other than vehicles, such as pedestrians and bicycles. In general many pedestrian/bicycle crashes go unreported. Therefore, the absence of reported pedestrian/bicycle crashes in a five-year period of crash data does not necessarily indicate safe conditions for these users.

Table 4 *Interchange Area Crash Data, 2018-2022*

	Number of Crashes					
	Fatal	Personal Injury*			Property Damage	Total Crashes
		Type A	Type B	Type C		
Segments						
I-94 Mainline West Segment	0	0	2	5	43	50
I-94 Mainline East Segment	1	1	6	2	37	47
Intersections						
20th St & 28th Ave WB on-ramp	0	0	0	1	10	11
20th St & EB off-ramp	0	0	0	2	6	8

** Personal Injury Crashes include Type A (Serious Injury), Type B (Minor Injury), and Type C (Possible Injury).*

The five-year crash and severity rates for each segment and intersection were compared to the five-year statewide average rates and the five-year critical rates for similar segments and intersections. Locations with crash or severity rates above the critical rates are generally considered in need of safety improvements. The crash rate is expressed in crashes per million vehicle miles traveled (MVMT) and per million entering vehicles (MEV) for segments and intersections, respectively. The severity rate is expressed in fatal and serious injury crashes per 100 million vehicle miles traveled (100 MVMT) and per 100 million entering vehicles (100 MEV) for segments and intersections, respectively. The results are shown in **Table 5**. Crash calculation sheets are also included in Appendix A.

Table 5 *Crash Rates 2018-2022*

Location	Crash Rates (per MVMT/MEV)			Severity Rates (per 100 MVMT/100 MEV)		
	Observed Crash Rate	Average Statewide Crash Rate	Critical Crash Rate	Observed Severity Rate	Average Statewide Severity Rate	Critical Severity Rate
Segments						
I-94 Mainline West Segment	**0.877**	0.944	1.280	**0.000**	0.592	2.780
I-94 Mainline East Segment	**0.641**	0.944	1.240	**2.727**	0.592	2.430
Intersections						
20th St & 28th Ave WB on-ramp	**0.263**	0.592	0.910	**0.000**	0.824	3.820
20th St & EB off-ramp	**0.161**	0.592	0.880	**0.000**	0.824	3.480

The predominant crash patterns, trends, and types of crashes were identified and are summarized below:

- The observed crash rates for the I-94 segments and ramp terminal intersections were all below the critical crash rates for similar segments and intersections. Only the east segment of the I-94 mainline had a severity rate that was above the critical rate due to one fatal and one serious injury crash.

- The fatal crash occurred on the east segment of the mainline and involved two combination trucks and an SUV where one truck lost the ability to brake and rear ended the SUV into the other truck. The SUV occupant was killed in the crash. The serious injury crash involved a single vehicle rollover at high speeds following a police chase while the driver was under the influence of alcohol.

- Out of 97 reported crashes on the mainline, run off road/single vehicle crashes (59) were the most common crash type. Other crash types include rear end crashes (24) and sideswipe crashes (14). Ten mainline crashes were likely related to vehicles entering or exiting the highway within the weave sections, mostly between 20th Street and US 75 and resulting only in possible injury and property damage.

- There was a higher concentration of rear end crashes on the mainline I-94 segment west of 20th Street, some of which were related to traffic congestion and backups that are known to frequently occur in the westbound direction in the area of the I-94 bridge over the Red River.

- There were 19 total intersection related crashes at the two ramp terminal intersections. The most common crash type at the intersections were rear end crashes (10). Other crash types include angle crashes (5), sideswipe crashes (3), and one head-on crash. Two rear-end crashes and one angle crash resulted in possible injury.

2.9 Land Use and Zoning

Existing zoning surrounding the interchange includes parcels in the northeast quadrant zoned as Regional Commercial (RC) and Heavy Industrial (HI), in the northwest quadrant as Institutional (INS), in the southeast quadrant as Residential Low Density 1 and 2 (RLD1 & RLD2), and in the southwest quadrant as Institutional (INS), Community Commercial (CC), and Residential High Density 1 (RHD1).

Existing land use occupying the parcels is generally consistent with zoning, with a Ken's Sanitation and Recycling, MacroSource (formerly Gavilon Fertilizer), and the Anheuser-Busch Malt Plant in the northeast quadrant, M-State in the northwest quadrant, a single-family and duplex home neighborhood in the southeast quadrant, and Triumph Lutheran Brethren Church, commercial properties, and multi-family apartment buildings in the southwest quadrant. Future land use highlighted in the 'City of Moorhead 2022 Comprehensive Plan' is also generally consistent with existing land use and zoning. Existing zoning and future land use is shown in Appendix A.

Additionally, the Moorhead Travel Information Center/Rest Area located off the eastbound lanes of I-94 is approximately 1,600 feet east of 20th Street. The rest area allows travelers entering Minnesota to stop for restrooms, vending, a picnic area, and tourist information, and has parking for passenger cars and combination trucks.

2.10 Environmental Considerations

Environmental features in the vicinity of the interchange were identified and briefly reviewed to ensure they are considered in the development of alternatives and impacts to them are understood.

Wetlands were identified and classified using the National Wetlands Inventory (NWI) Wetlands Mapper. A Riverine habitat is present to the north of I-94 running east and west starting from the west end of the primary study area, entering a culvert in between the westbound on-ramp and 28th Avenue, and daylighting outside of the study area east on the rest area. A 0.54-acre Freshwater Emergent Wetland habitat is present in the southeast quadrant of the interchange immediately east of the railroad and south of I-94. A 0.35-acre Freshwater Emergent Wetland habitat is present immediately southeast

of the off-ramp entering the rest area. Additional Freshwater Pond habitats are present east of the study area along the south side of I-94 and along the south side of 28th Avenue. A map of the existing wetlands is shown in **Figure 11**.

Figure 11 *Existing Wetlands*

Floodplains were identified using the FEMA Flood Map Service Center. Most of I-94 in the interchange area and portions of the ramps lie within Flood Zone X 'Other Flood Areas', which describes areas of 0.2% (500 year) annual chance of flood, areas of 1% (100 year) annual chance of flood with average depths of less than one foot or with drainage areas less than one square mile, and areas protected by levees from 1% (100 year) annual chance of flood. A map of floodplain is shown in Appendix A.

Sites requiring permits were identified using the Minnesota Pollution Control Agency (MPCA) What's in My Neighborhood map. Permits for various types of potential pollutants were identified from active and inactive sites. Construction stormwater permits were noted for construction activity on I-94, 20th Street, 28th Avenue, and the M-State parking lot expansion/replacement, of which only the M-State site is active. Ken's

Sanitation and Recycling was identified as having permits for having potential pollution involving underground tanks, industrial stormwater pollution, and hazardous waste, of which the stormwater and hazardous waste are active, but a minimal quantity generator. MacroSource/Gavilon Fertilizer was identified for having permits involving aboveground tanks, air quality, industrial stormwater pollution, and toxics reduction, all of which are active. Lastly, several properties on 20th Street adjacent to I-94 and the eastbound off-ramp were identified for having hazardous waste and petroleum remediation as part of a leak site, all of which are inactive.

Apart from the previously identified rest area and shared-use paths along 20th Street and 28th Avenue, there are no parks or recreation areas within the interchange area. Community amenities including schools are limited to M-State in the northwest quadrant of the interchange and the rest area.

Environmental Justice (EJ) categories were examined using the EPA Environmental Justice Screening and Mapping Tool and data provided by Metro COG. The area in the southwest quadrant of the interchange is above the 50th percentile in populations of people of color, low income, and higher unemployment rate, and a minority population of approximately a 30 percent. The area in the northwest quadrant is above the 50th percentile in populations of low income and age over 64. Maps of EJ areas are shown in Appendix A.

There are no known cultural resources in the study area.

2.11 Previous Studies

Several related studies within the primary and secondary study areas were performed prior to the I-94 and 20th Street Interchange Analysis.

2.11.1 TH 75 and 20th Street Corridor Study Report (2008)

This study identified future improvement needs along 20th Street from Main Avenue to 60th Avenue, including the ramp terminal intersections. The study concluded that the preferred 20th Street cross section through the interchange is a four-lane divided section with continuous median and turn lanes, and the preferred 20th Street interchange layout is a conversion to a full access interchange with a new westbound off-ramp in the northeast quadrant with a ‘Button Hook Connection’ to 28th Avenue and a new eastbound on-ramp loop in the southwest quadrant, which would not meet MnDOT design standards due to a reduced radius to minimize impacts to surrounding parcels.

2.11.2 Moorhead East Growth Area AUAR (2018)

The AUAR examined future land development scenarios of an over 4,000-acre area of eastern Moorhead Township and southern Dilworth east of 34th Street. While outside the study area of the 20th Street interchange, the development scenarios were considered when analyzing the forecasted traffic expected to travel through the interchange.

2.11.3 2045 Metro Grow: Fargo-Moorhead Metropolitan Transportation Plan (2019)

This latest long-range transportation plan includes transportation planning strategies to shape the Fargo-Moorhead area transportation network for the next 20 years. While no specific recommendations are made to the 20th Street interchange, the plan generally prioritizes collaborating with MnDOT to improve/ preserve uninterrupted traffic flow on I-94 and creating transportation facilities that promote multimodal inclusion.

2.11.4 US 10/75 Corridor Study (2020)

This study developed context sensitive solutions for US 75 north of I-94, the concurrent route section in downtown Moorhead, and US 10 east of downtown. While the study does not cover 20th Street, the recommendations for these two major corridors may influence future traffic patterns on 20th Street and at the interchange.

2.11.5 Interstate Operations Analysis Report (2023)

This report covers a high-level study of interstate operations in the Fargo-Moorhead area to identify prioritized improvements to improve safety, traffic operations, and mobility, including along I-94 through Moorhead. The study identifies that the 20th Street interchange may have local access and connectivity needs that warrant conversion to a full access interchange and selected the interchange to be a mid-term project to occur concurrently with the I-94 reconstruction and expansion to a six-lane freeway facility. Forecast traffic volumes from this study developed using the Advanced Traffic Analysis Center's (ATAC) 2045 Fargo-Moorhead Travel Demand Model (TDM) and accounting for conversion of the 20th Street interchange to full access will be used in the I-94 and 20th Street Interchange Analysis for estimating operational performance of the developed interchange alternatives.

3 Purpose and Need

This project intends to decrease vehicle miles traveled and travel time for roadway use, maintain roadway mobility while extending the congestion-free operations of I-94 and the functionally classified roadway network between 8th Street and 34th Street, and to support the active transportation in the area.

3.1 System Linkage

Limited access to I-94 from the 20th Street interchange increases roadway users' vehicle miles traveled (VMT) and travel time. For example, a motorist on westbound I-94 needs to exit at either the 8th Street or 34th Street off-ramps to access destinations adjacent to the 20th Street interchange. This would be similar for vehicles on 20th Street who wish to access I-94 eastbound.

The unconventional access to 20th Street, coupled with signage referencing the 8th Street and 34th Street exits, provide confusion for drivers expecting a full access interchange. Vehicles utilizing the eastbound exits from I-94 to 20th Street may not realize that there is no access back to the eastbound interstate. The unconventional access is further exacerbated during traffic incidents on westbound I-94 between 34th Street and 8th Street; the inability for westbound traffic to exit at 20th Street causes traffic to back up and/or stop on I-94.

The partial access provided at the 20th Street Interchange violates the current Federal Highway Administration (FHWA) policy that requires full movement at an interstate access unless a compelling reason is given.

3.2 Traffic Operations

Traffic diverted to adjacent interchanges also impacts traffic operations and level of service (LOS) at the two interchanges east and west of 20th Street. Intersection operations are evaluated in terms of average seconds of delay per vehicle. The average number of seconds of delay is broken into six ranges assigned letter grades A through F defining each LOS. It is generally recognized that LOS D is the lowest acceptable for urban intersections/ segments.

3.3 Supporting Active Transportation

Bicycle and pedestrian transportation was an important component of the 2045 Fargo-Moorhead Metropolitan Transportation Plan. The transportation plan outlines the goal to create complete streets with improved traffic flow and safer pedestrian facilities. I-94 creates a barrier for active transportation users where there are limited crossing opportunities, therefore future improvements to the 20th Street interchange should maintain and enhance pedestrian and bicycle safety and connectivity within the community, especially in the vicinity of Minnesota State Community and Technical College (M-State) which may potentially generate a high number of active transportation trips.

4 Public and Agency Engagement

A multifaceted public participation plan was implemented for this study. Engagement efforts included Study Review Committee Meetings, Stakeholder Engagement Meetings, Public Input Meetings, a project specific website, postcard mailings, media and social media outreach, newspaper ads, online surveys and emails to interested persons lists.

4.1 Study Review Committee Meetings

A Study Review Committee (SRC) was established at the start of the study to provide input on the existing and future conditions to be addressed, provide feedback on the alternatives as they were developed, and coordinate with others in their agencies. While some members of the SRC attended all of the meetings, others participated as needed depending on the meeting subject. SRC participants included:

- **FM Metro COG:** Dan Farnsworth, Ben Griffith
- **City of Moorhead:** Jonathan Atkins, Forrest Steinhoff, Clay Lexen, Tom Trowbridge
- **MnDOT District 4:** Mary Safgren, Jerilyn Swenson, Amanda Ellingson, Makala Girodat, Trudy Kordosky, Kevin Lachowitzer, Rosemary Bruce-White
- **MnDOT Central Office:** Jamal Love
- **FHWA:** Abbi Ginsberg
- **NDDOT:** Wayne Zacher, Will Hutchings
- **Stantec:** Wade Frank, Keith Strickland, Angie Bolstad, Adam Capets, Jeremy Friehammer

4.1.1 SRC #1 – July 10, 2023

SRC #1 served as the study kickoff meeting and included discussion on the scope and schedule of the study, a review of the existing conditions in the study area, and confirmation of the planned public engagement and project stakeholder meetings.

4.1.2 SRC #2 – August 30, 2023

SRC #2 focused primarily on the draft Purpose and Need of the project and a Fatal Flaw discussion in which the group discussed what types of impacts and design criteria decisions would be viewed as fatal flaws when developing alternatives.

4.1.3 SRC #3 – November 4, 2024

SRC #3 was held to discuss the Travel Demand Modeling efforts, the initial interchange concept screening process, and to review the five interchange alternatives identified for study.

4.1.4 SRC #4 – February 25, 2025

SRC #4 included a recap of the stakeholder meetings, a discussion on the updated alternatives that came about as a result of the stakeholder meetings and a preview of the second public input meeting.

SRC Meeting agendas and minutes are included in Appendix B.

4.2 Stakeholder Meetings

An important part of the engagement plan for this study was to conduct meetings with property owners and other stakeholders who use 20th Street, 28th Avenue and the interchange regularly. Two stakeholder meetings were held at the Metro COG office on February 3rd, 2025. The meetings started with each of the stakeholders explaining how their facility and/or services use the transportation network in the area and whether or not they viewed a full interchange as a benefit. They were then shown the alternatives under consideration and provided comments. Following is a brief summary of the meetings. Full meeting notes are included in Appendix C.

Stakeholder Meeting #1 included representatives from Triumph Lutheran Church, Moorhead Fire Department, Moorhead Public Schools, Moorhead Public Service, MState, MSUM, and MATBUS.

- Triumph Church stated that they have tentative plans to expand their facility and were waiting to find out whether or not this project would affect the expansion plans. They also expressed concern if any of the alternatives resulted in the eastbound off-ramp moving closer to their facility from a noise perspective.
- The Fire Department indicated that ramps to and from the east would help with their response times and that two lanes in each direction on 20th Street would be preferred to help get across I-94 efficiently. They also noted that if the interchange were closed during construction, they would be able to provide services using a temporary fire station south of I-94.
- MState stated they are concerned about the loss of parking lot space resulting from one of the alternatives and also noted that there are vehicles cutting through

their parking lot in order to turn left onto 20th Street since that turning movement isn't allowed at the intersection of 28th Avenue and 20th Street.
- Moorhead Public Service made the team aware of the facilities they owned within the project limits including the water tower, the power transmission line and substation, and a watermain under 28th Avenue near the water tower.
- MSUM said most of their students and staff use 8th Street but that a full interchange at 20th Street would be beneficial in the long term.
- Moorhead Public School buses use 28th Avenue east of 20th Street and said a full interchange would be beneficial as it would allow their buses to avoid delays from trains crossing 28th Avenue. They also said they could work around full closure of the interchange during construction to maintain bus service.
- MATBUS has one route in the area (Route 5) that uses 20th Street and 28th Avenue to the west of 20th Street.

Stakeholder Meeting #2 included representatives from MacroSource (Formerly Gavilon Fertilizer), Ken's Sanitation, FMWF Chamber of Commerce, Moorhead Public Schools, and BNSF Railway.

- MacroSource and BNSF noted that the revised 28th Avenue connection as shown would not be feasible as it would cross the track switch that diverts railroad cars to the MacroSource facility.
- Ken's Sanitation noted that their truck scale is located on the south side of the facility and would need to be accessed from 28th Avenue South. MacroSource and Ken's Sanitation also expressed interest in expanding their facilities.
- BNSF stated that the replacement of the railroad bridge over I-94 would require a temporary shoo-fly crossing of the interstate to maintain rail traffic throughout construction.

4.3 City of Moorhead Coordination

On February 21, 2025, the project team held a coordination meeting with staff from City Engineering, Community Development, and Economic Development. The primary focus of the meeting was to discuss the alternatives under consideration and for City staff to relay information related to potential development in the area. The Anheuser-Busch facility in the northeast quadrant had recently closed and offered for sale. The City was receiving significant interest in developing the property, including the potential for high traffic generating facilities such big box retail, commercial retail, and multi-family housing. The City indicated that maintaining the existing connection of 28th Avenue on both sides of 20th Street is a priority for them given the development potential. They also

noted that the White Earth Tribe was planning to purchase land near Exit 6 east of Moorhead to build a casino and convention center and were concerned how that facility might impact traffic in Moorhead. There was also discussion of the ongoing MnDOT study of I-94 between the Red River and Exit 6 and how it may be beneficial for both studies if MnDOT evaluated the potential traffic impacts resulting from these new development efforts.

4.4 Public Input Meetings

Two public input meetings were completed to gain an understanding of the community's issues, needs, and opinions regarding the interchange study.

The public input meeting summaries can be viewed in Appendix D.

4.4.1 PIM #1

Metro COG and Stantec hosted the first public input meeting on September 19, 2023. The meeting was held from 5PM to 7PM at the Minnesota State Community and Technical College (M-State) in the Bergos Rooms. The public was notified via a press release, social media posts, a newspaper ad, an email announcement, Metro COG website announcement, and postcards sent to 64 property owners in the vicinity of the interchange.

Approximately 20-25 people attended to learn about the study background and purpose, and to provide input regarding the future improvements made to the I-94 and 20th Street Interchange. During the meeting, attendees were provided with handouts describing the project, study purpose, primary and secondary study area, tentative project schedule, contact information, and how to stay involved, along with informative boards displaying a welcome sign, the project background, project logistics, existing conditions, and key features. They were also able to leave a general comment on the provided comment cards and post-it notes on the project layout roll plot. They were also given the option to send their comments to Dan Farnsworth via email, mail, or online through the project website. Comments received during and after the meeting included:

- 17 people were in favor of a full interchange or would find it beneficial
- 4 people indicated they did not see the benefit of a full interchange
- Several comments indicated frustration/confusion with the combined northbound through and right turn lanes (traffic backups, long waits for trains)

- Several comments asked for improved connectivity between 20th and 34th Streets.
- One commenter indicated a preference to retain the existing pedestrian bridge if a full interchange is constructed.

4.4.2 PIM #2

The second public input meeting was held from 5PM to 7PM on March 11, 2025 at the Triumph Lutheran Brethren Church in Moorhead. The public was notified via press release, social media posts, a newspaper ad, an email announcement, Metro COG website announcement, and postcards mailed to 79 property owners in the vicinity of the interchange.

Approximately 30-35 people attended the public open house. The purpose of this meeting was to keep the public informed of the study progress and solicit feedback on the two interchange alternatives. This meeting provided both online and in-person engagement opportunities for the public.

Online engagement consisted of project information and materials, a public survey, an email sign-up option and contact information. Online engagement was held on the project webpage which was hosted as a part of Metro COG's website. The same materials presented along with the same survey that was provided at the in-person meeting were shown online.

A summary of the comments received is included in Section 6 of this report.

5 Travel Demand Modeling

Travel demand modeling is essential to discuss the methodology, assumptions and model results regarding the base year model calibration, future year trip estimation, future year traffic forecasts for the no-build scenario, and the future year traffic forecasts for the build scenario. The 2050 Fargo-Moorhead Regional Model was used for this study. The model was calibrated to observed conditions using Screenline Analysis and Origin-Destination Matrix Estimation (ODME).

Future year trip estimates were obtained from the regional model and scaled in accordance with the Screenline Analysis. These trips were then used to estimate the future No-Build and Build scenarios. The evaluation showed that for the new westbound off-ramp that would be constructed as part of the build scenario, about half of the traffic volume would be from long-distance trips coming from east of the study area, while the other half would be the result of local trips entering I-94 from Main Avenue or 34th Street. Similar patterns were observed for the new eastbound on-ramp with approximately half of the trips within the study area and half long-distance trips. The estimated future traffic volumes for the new interchange ramps are comparable to the volumes at the other interchanges in the study area, indicating that a full interchange at 20th Street would be beneficial to the local Interstate system.

Figures 12 (8th Street), 13 (20th Street) and 14 (Main Avenue and 34th Street) on the following pages show the AM and PM peak hour volumes for the interchange ramps. Current/baseline volumes are in blue, future (2050) no-build volumes are in orange, and future (2050) build volumes are in pink. In lieu of using the proposed interchange configurations for the 20th Street Interchange graphic, the volumes for the new eastbound on-ramp and westbound off-ramp are shown in the southeast and northeast quadrants respectively for simplicity.

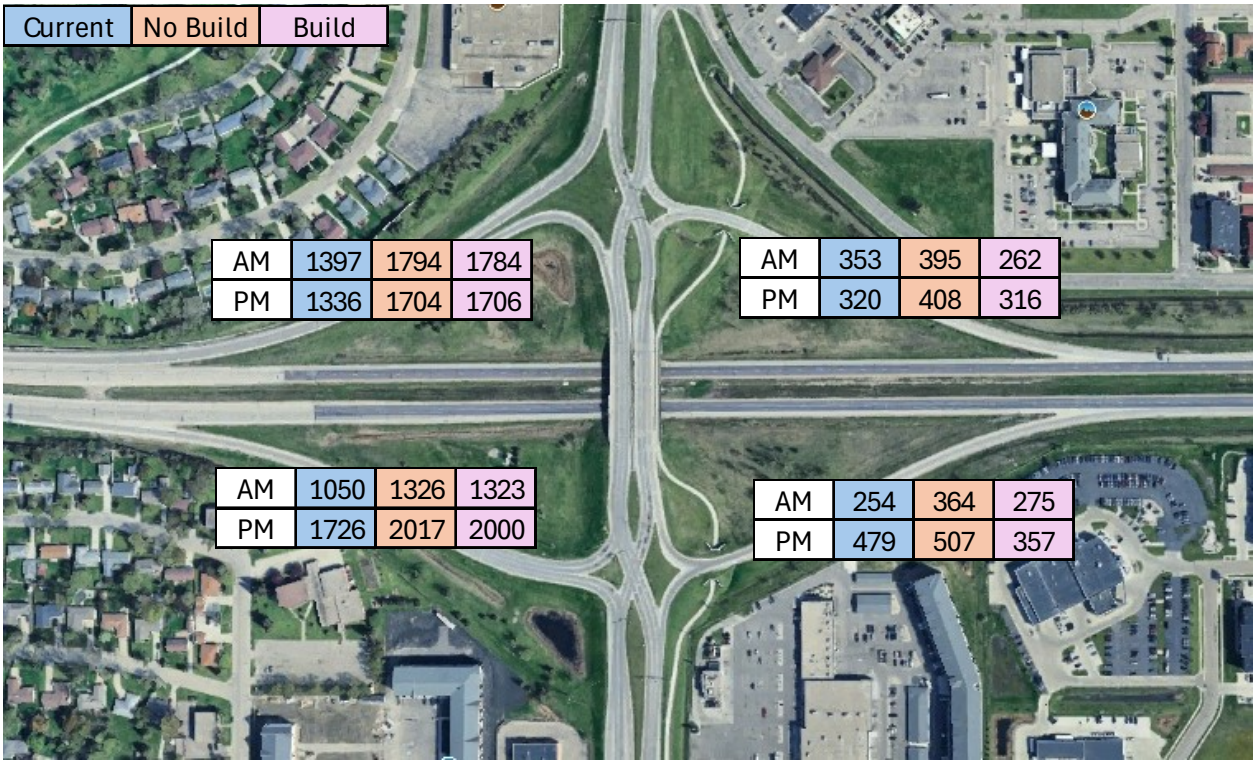


Figure 12 *8th Street Interchange Ramp Volumes*

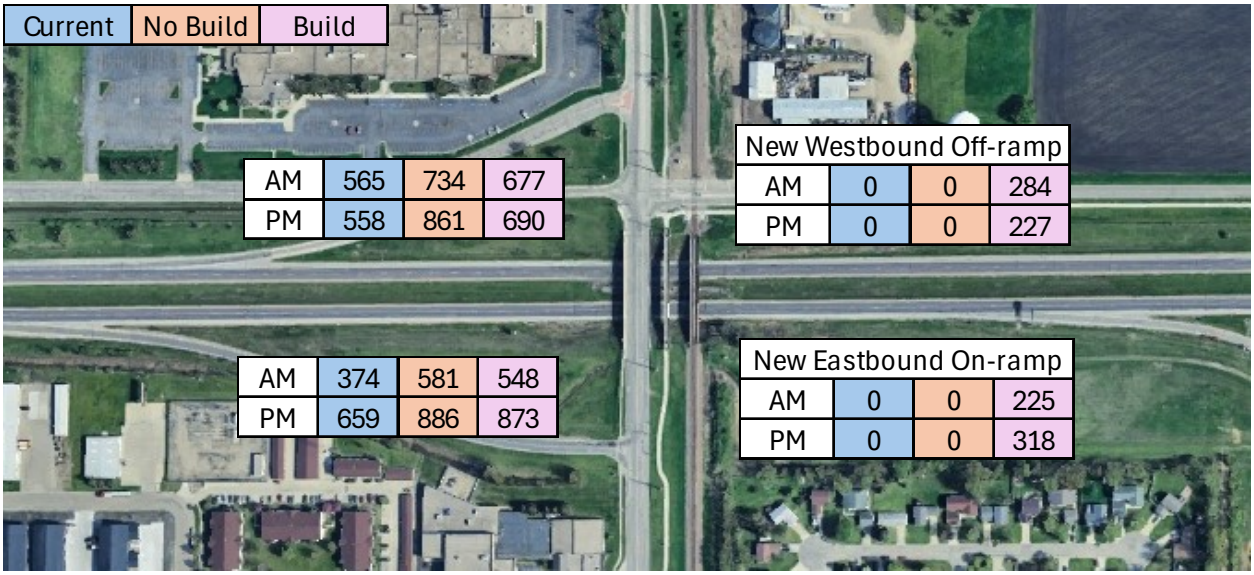


Figure 13 *20th Street Interchange Ramp Volumes*

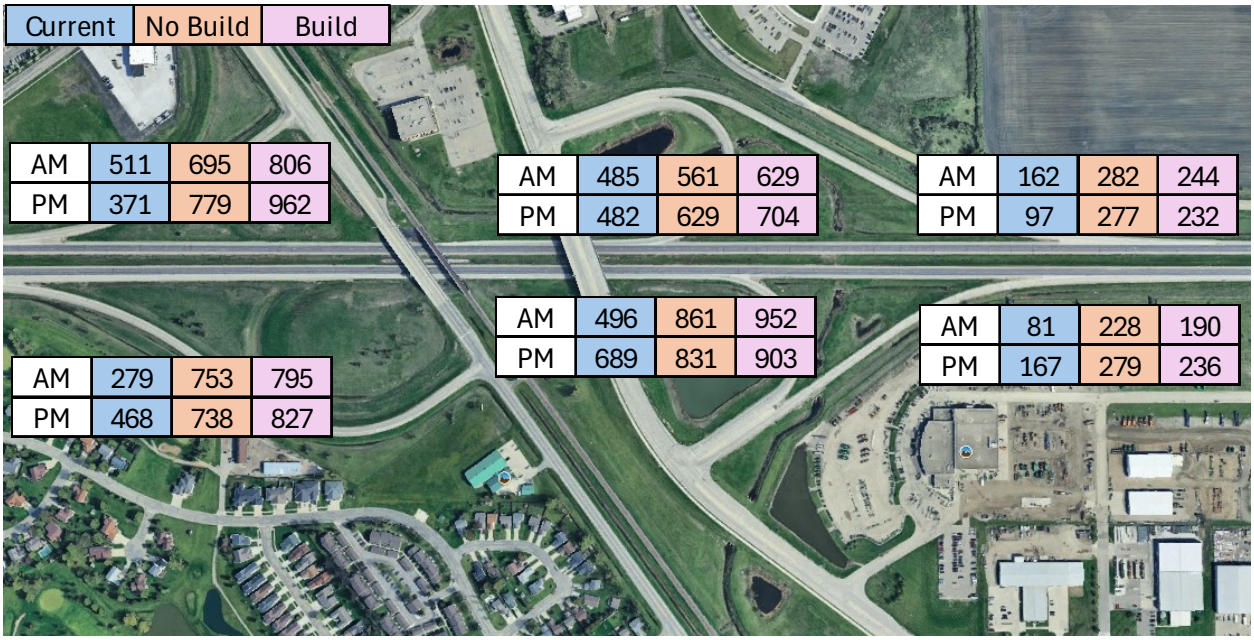


Figure 14 *Main Avenue and 34th Street Interchange Ramp Volumes*

Evaluation of the AM and PM peak hour volumes at the study area interchanges shows the following:

8th Street Interchange

- The eastbound off-ramp and westbound on-ramp show little change in traffic volume.
- The westbound off-ramp and eastbound on-ramp show traffic volume reductions of 25 to 35%, indicating that a full interchange at 20th Street would provide relief to this interchange.

20th Street Interchange

- The eastbound off-ramp volumes for the build scenario and similar to the no-build.
- The westbound on-ramp volumes show a reduction of 10 to 20% for the build scenario versus the no-build. This could indicate that some 20th Street traffic planning to travel eastbound on I-94 are first traveling west to the 8th Street Interchange.

- The new eastbound on-ramp and westbound off-ramp show similar volumes for the same movements as the 8th and 34th Street Interchanges indicating similar effectiveness.

Main Avenue Interchange

- The westbound on-ramp traffic volumes show an increase of 16 to 23% and the eastbound off-ramp shows an increase of 6 to 12%. This indicates there is traffic using the interstate to travel between 20th Street and Main Avenue, which reduces traffic volumes on the local road network in the study area.

34th Street Interchange

- Traffic volumes on the westbound off-ramp and eastbound on-ramp show reductions of approximately 20% indicating that the new 20th Street ramps provide relief to this interchange.
- Similar to Main Avenue, the westbound on-ramp and eastbound off-ramp show an increase of 10 to 12%, indicating that local traffic would use the Interstate to travel between 20th and 34th Streets, which reduces traffic volumes on the local road network in the study area.

The full travel demand modeling memorandum with exhibits is included in Appendix E.

6 Alternatives Analysis

The interchange concepts for this study were developed to provide a full interchange configuration while minimizing right of way impacts and complying with current design standards. The goal of this study was to identify and evaluate up to five build alternatives for analysis and screening them down to two feasible alternatives to be carried forward into the next phase of project development. The primary constraint in developing a full interchange at this site is the presence and proximity of the BNSF Railway track on the east side of and parallel to 20th Street. Crossing railroad tracks with interchange ramps is not permitted, therefore interchange concepts studied consisted of interchange configurations with all ramps on the west side of 20th Street, or elevated configurations to all new ramps on the east side of 20th Street to be constructed over the railroad track. The alternatives analysis consisted of three steps: high level screening, initial alternatives evaluation, and final alternatives refinement as described in the following sections.

6.1 No-Build Alternative

The No-Build Alternative consists of continued operation of the existing half diamond interchange. Public input comments noted some residents feel existing signage is insufficient to effectively communicate the lane assignments on northbound 20th Street. Therefore, the no-build alternative may include improvements to the existing signing and pavement marking at the current interchange.

6.2 High-level Screening

The initial high-level screening of interchange concepts consisted of using The Highway Interchange Tool (HIT), which is a proprietary tool developed by Stantec to investigate feasible interchange layouts based on a series of volume, geometric, and area characteristics inputs. The HIT examines several dozen unique interchange layouts with many variations for each layout. The HIT delivers a final score for each layout based on three categories: operational efficiency, safety, and cost.

The HIT was conducted independently for AM and PM peak hour volumes, however most of the interchange layouts that resulted from the analyses were the same between both peak hours. The roughly top 20 scoring layouts for peak hours were selected and their AM and PM scores were summed and ordered from highest to lowest into an aggregate list of top alternatives. The results included some duplicate interchange

layouts; thus they were excluded from the final list. This list of top interchange layouts and their respective aggregate scores are shown in **Table 6**.

Table 6 *Top Scoring Interchange Concepts from HIT*

Interchange Layout Name	AM & PM Total Score
Diverging Diamond Interchange (DDI)	13.1
Diamond with U-turn for Arterial Lefts	12.6
Diamond with U-turn over Freeway and Slip Lanes for Arterial Lefts	12.5
Single Quadrant	12.0
Diamond Single Point with Displaced Ramp Lefts	11.9
Diamond Single Point/Single Point Urban Interchange (SPUI)	11.8
Diamond with U-turn for Arterial and Ramp Lefts	11.8
Diamond with Contraflow Arterial Lefts and U-turn for Ramp Lefts	11.6
Elevated Double U-turn	11.6
Standard Diamond	11.6
Diamond Single Point with Displaced Arterial Lefts	11.3
Half Clover/Parclo	11.3
Diamond Single Point with U-turn for Arterial Lefts	10.8
Diamond with Displaced Arterial Lefts and U-turn for Ramp Lefts	10.8
Diamond with Displaced Arterial Lefts	10.7

Due to the existing constraints involving the railroad to the east of 20th Street, some of the concepts resulting from the HIT analysis are less feasible than others. Many of the concepts require utilizing all quadrants, which would require additional grade separation from the railroad and thus increased structure costs for 20th Street. Roadway and structure width on 20th Street should be minimized to keep structure costs as low as possible. Interchange layouts involving single point intersections, displaced lefts, or contraflow lefts require additional width on 20th Street to accommodate the geometry and thus should be avoided. While the DDI also may require additional roadway and structural width, since it results in the highest score, it was not excluded.

Stantec's design team conducted additional screening of the concepts above to narrow down to five alternatives for development. Several of the concepts were removed primarily due to the large construction footprint required which would result in extensive property impacts and right of way costs. Others were removed due to impacts to the access the existing properties in the study area have to 20th Street. There were also

several concepts that were variations of a diamond interchange that did not offer significant advantages over the DDI or tight diamond interchange. The five alternatives selected for development were:

- Alternative 1 – Elevated Diverging Diamond Interchange
- Alternative 2 – Elevated Tight Diamond Interchange
- Alternative 3 – Three Level Diamond Interchange
- Alternative 4 – Single Quadrant Interchange
- Alternative 5 – Partial Cloverleaf (Parclo) Interchange

The Highway Interchange Tool Results memorandum can be found in Appendix F.

6.3 Initial Alternatives Screening

For each alternative, a layout drawing was established to verify that the interchange configurations were feasible and could meet MnDOT design requirements. The layouts were also used to establish preliminary right of way impacts and to prepare preliminary cost estimates. With input from the SRC, a weighted screening matrix was prepared to evaluate the alternatives against criteria related to safety and mobility, property impacts, infrastructure impacts (utilities, bridges, etc.), and compatibility with potential I-94 mainline expansion.

All of the alternatives affected the intersection of 28th Avenue South and 20th Street. On the west side of 20th, most of the alternatives resulted in terminating 28th Avenue with a cul-de-sac near M State. On the east side, 28th Avenue was re-routed to turn north and then tie into the 24th Avenue intersection. This new alignment was shown as passing through the existing recycling and fertilizer facilities, resulting in the need to acquire and relocate those properties. This alignment was necessary as Anheuser Busch had historically prohibited any development or construction on the agricultural land adjacent to those facilities. The cost of this property acquisition was not included in the initial alternatives screening as it is the same for all alternatives, and therefore not a differentiator.

6.3.1 Alternative #1 – Elevated Diverging Diamond Interchange (DDI)

Alternative 1 consists of constructing an elevated DDI to allow ramps from the east to be constructed over the BNSF track. This concept stays within the existing right of way and allows the existing pedestrian and railroad bridges east of 20th Street to remain in place. To maintain access to MnDOT's Travel Information Center and rest area, the new eastbound on-ramp would stay elevated to cross the realigned off-ramp for the rest area with a bridge. This alternative would result in the closure of the driveways at Triumph Lutheran Church in the southwest quadrant and would also require the relocation of the power transmission line (owned by Moorhead Public Service) on the east side of 20th Street. Construction of this concept would require full closure of the interchange throughout construction. This alternative (and Alternatives 2 and 3) requires the construction of extensive retaining walls to achieve the elevated crossings while staying within the right of way. The estimated cost is $41.8 million.

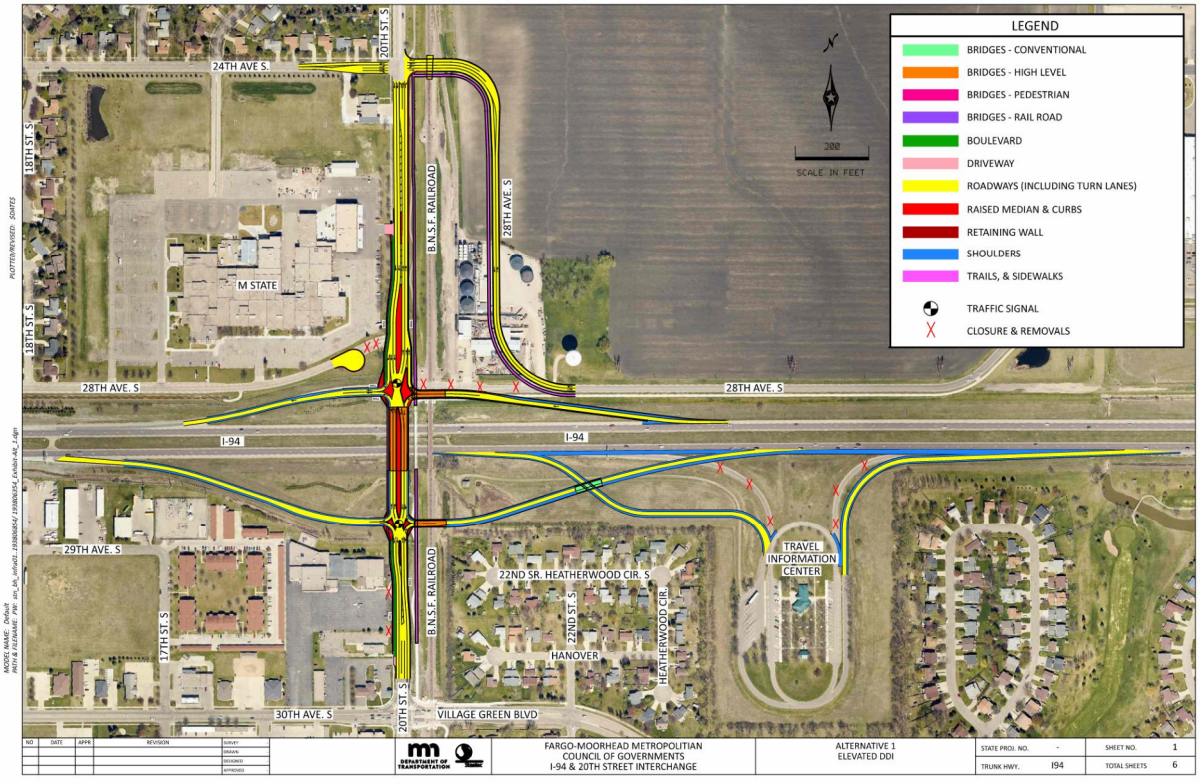


Figure 15 *Alternative 1 - Elevated DDI*

6.3.2 Alternative #2 – Elevated Tight Diamond

Similar to Alternative 1, this concept consists of constructing an elevated diamond interchange to allow ramps from the east to be constructed over the BNSF track. The tight diamond configuration has a smaller footprint (less pavement and narrower 20th Street Bridge) than the DDI. This concept stays within the existing right of way and allows the existing pedestrian and railroad bridges east of 20th Street to remain in place. To maintain access to MnDOT's Travel Information Center and rest area, the new eastbound on-ramp would stay elevated to cross the realigned off-ramp for the rest area with a bridge. This alternative would result in the closure of the driveways at Triumph Lutheran Church in the southwest quadrant and would also require the relocation of the power transmission line (owned by Moorhead Public Service) on the east side of 20th Street. Construction of this concept would require full closure of the interchange throughout construction. The estimated cost is $35.2 million.

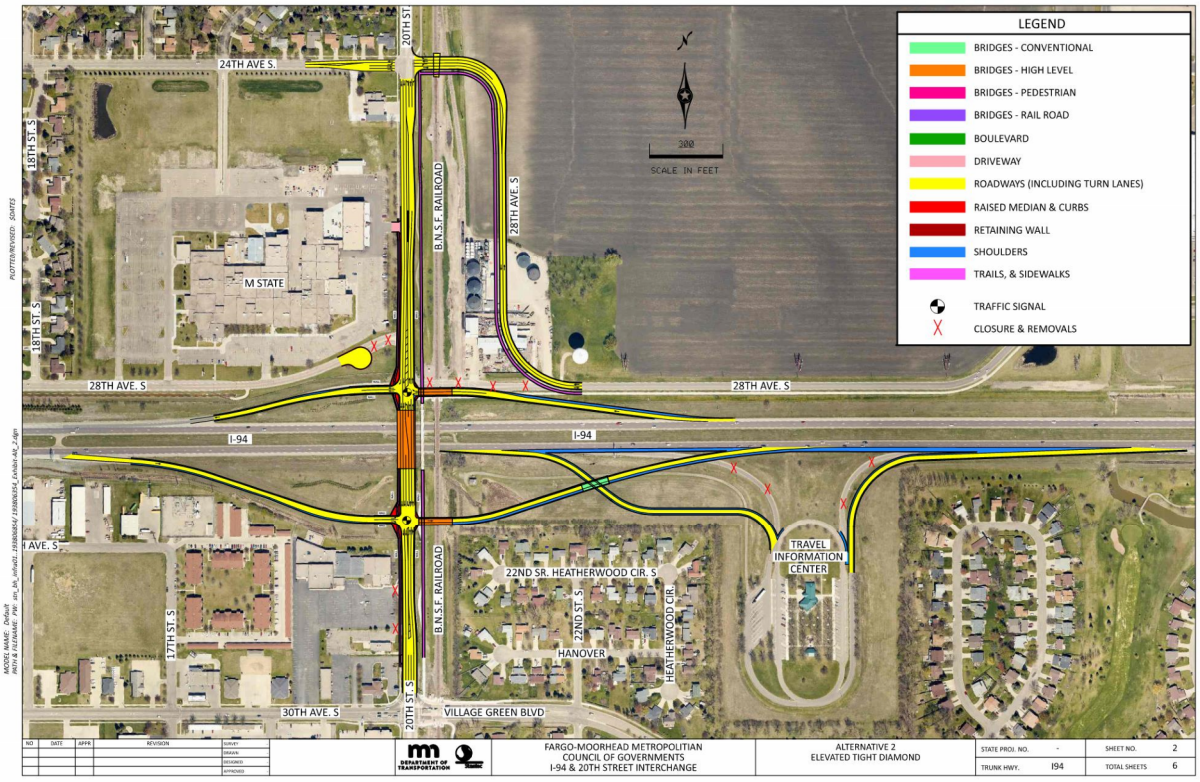


Figure 16 *Alternative 2 - Elevated Tight Diamond*

6.3.3 Alternative #3 – Three-level Tight Diamond Interchange

Alternative 3 was developed to provide an elevated concept that could maintain traffic on 20th Street and on the existing ramps through some or all of the construction period. The concept would keep the through traffic lanes on 20th Street and the west ramps at the existing grade. The east ramps would be elevated similar to the previous two alternatives and tie into an elevated bridge over the top of 20th Street. This alternative provides access to the rest area in the same manner as Alternatives 1 and 2 and maintains the existing pedestrian and railroad bridges. This is the only alternative that maintains the existing right-in/right-out connection of 28th Avenue on the west side of 20th Street. Alternative 3 requires some permanent right of way in the southwest quadrant and requires reconstruction of property accesses and requires relocation of the power transmission line. The estimated cost is $44.6 million.

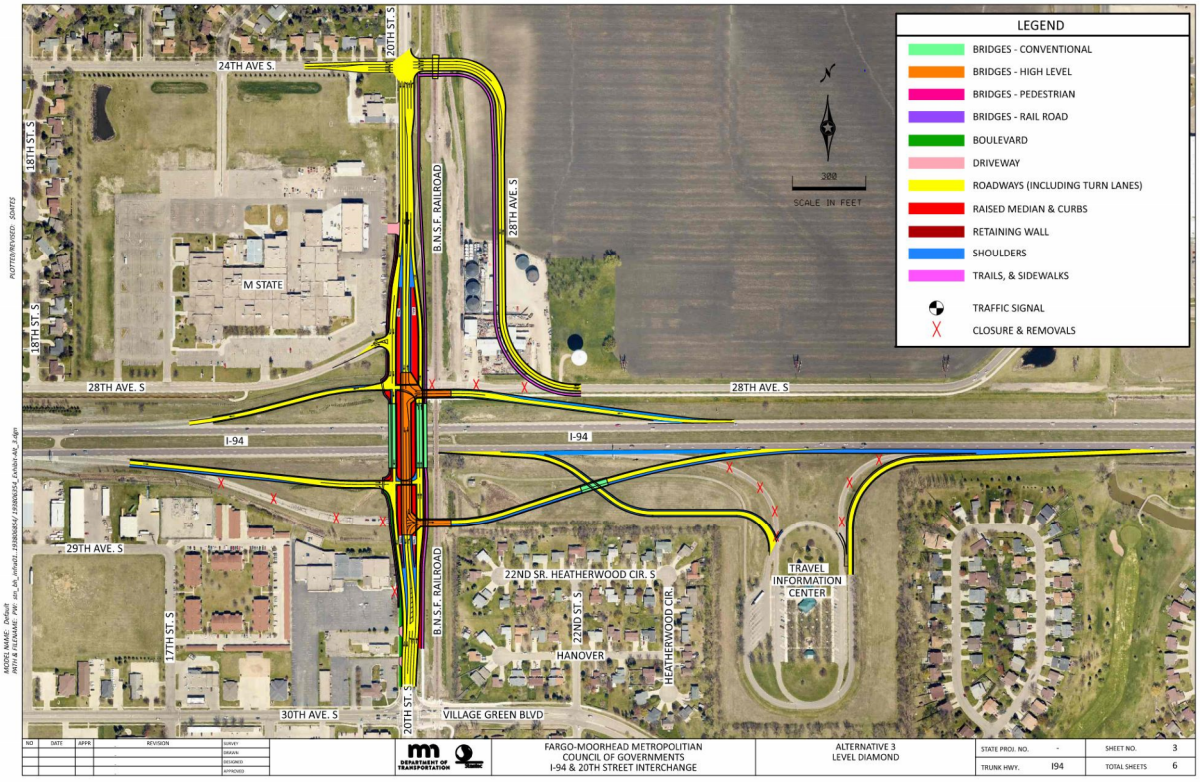


Figure 17 *Three-level Tight Diamond*

6.3.4 Alternative #4 – Single Quadrant Interchange

Alternative 4 is referred to as a Single Quadrant Interchange as it has 3 of the 4 ramps located in one quadrant. In this configuration, the westbound on-ramp is moved north to provide room for the new westbound off-ramp, resulting in impacts to the parking lot at M State. The new westbound off-ramp crosses under the 20th Street bridge on the north side of I-94 and then climbs up a curved alignment to cross over I-94 and tie the ramp into 20th Street on the south side of I-94. This alignment requires retaining walls to contain the ramp embankment on both sides of I-94. The eastbound off-ramp is pushed slightly to the south to allow room for the new eastbound loop on-ramp. The new ramps require acceleration/deceleration lanes on I-94, which requires the replacement of the railroad bridge due to the location of the bridge piers adjacent to the existing shoulders. The traffic on the new eastbound on-ramp would require merging/weaving with the eastbound off-ramp traffic accessing the rest area. This alternative does not require relocation of the power transmission line. The estimated cost is $24.9 million and includes costs associated with the railroad bridge replacement.

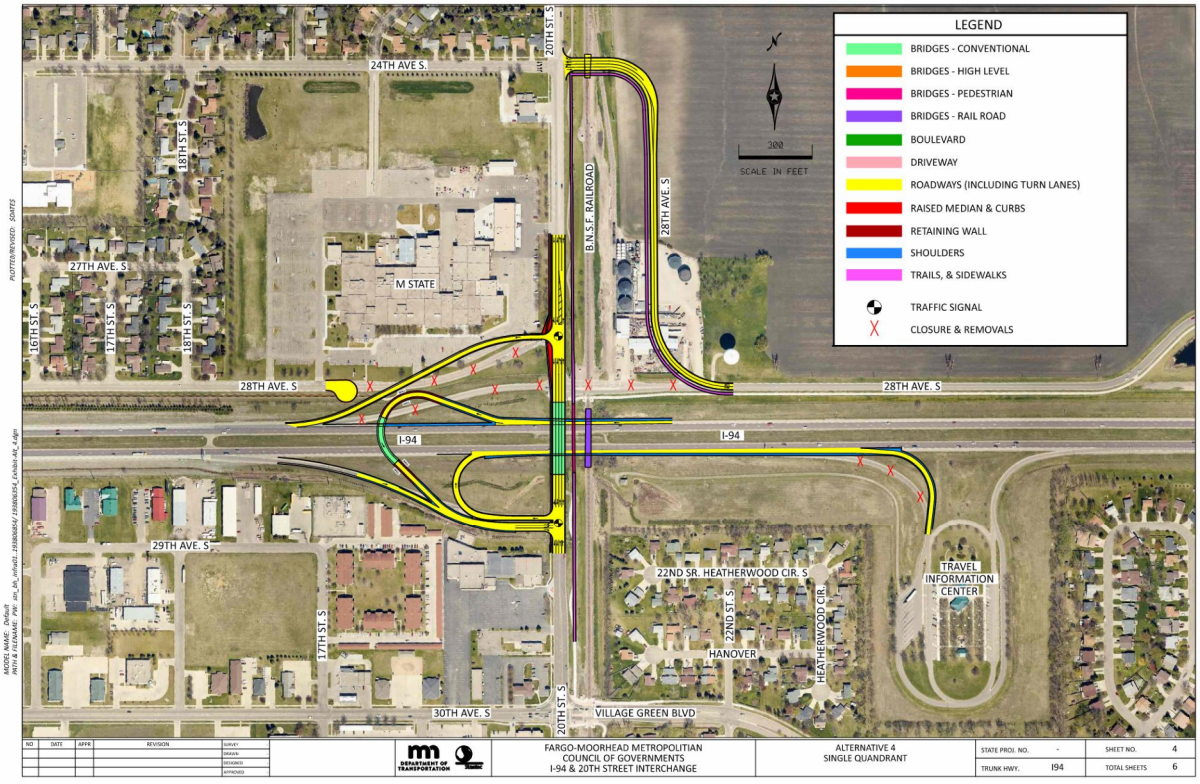


Figure 18 *Single Quadrant*

6.3.5 Alternative #5 – Partial Cloverleaf (Parclo) Interchange

Similar to Alternative 4, the Parclo interchange requires the westbound on-ramp to be moved north to allow room for the new westbound loop off-ramp, resulting in impacts to M State's parking lot. The eastbound off-ramp is pushed slightly to the south to allow room for the new eastbound loop on-ramp. The new ramps require acceleration/deceleration lanes on I-94, which requires the replacement of the railroad bridge due to the location of the bridge piers adjacent to the existing shoulders. The traffic on the new eastbound on-ramp would require merging/weaving with the eastbound off-ramp traffic accessing the rest area. This alternative does not require relocation of the power transmission line. The estimated cost is $20.7 million and includes costs associated with replacing the railroad bridge.

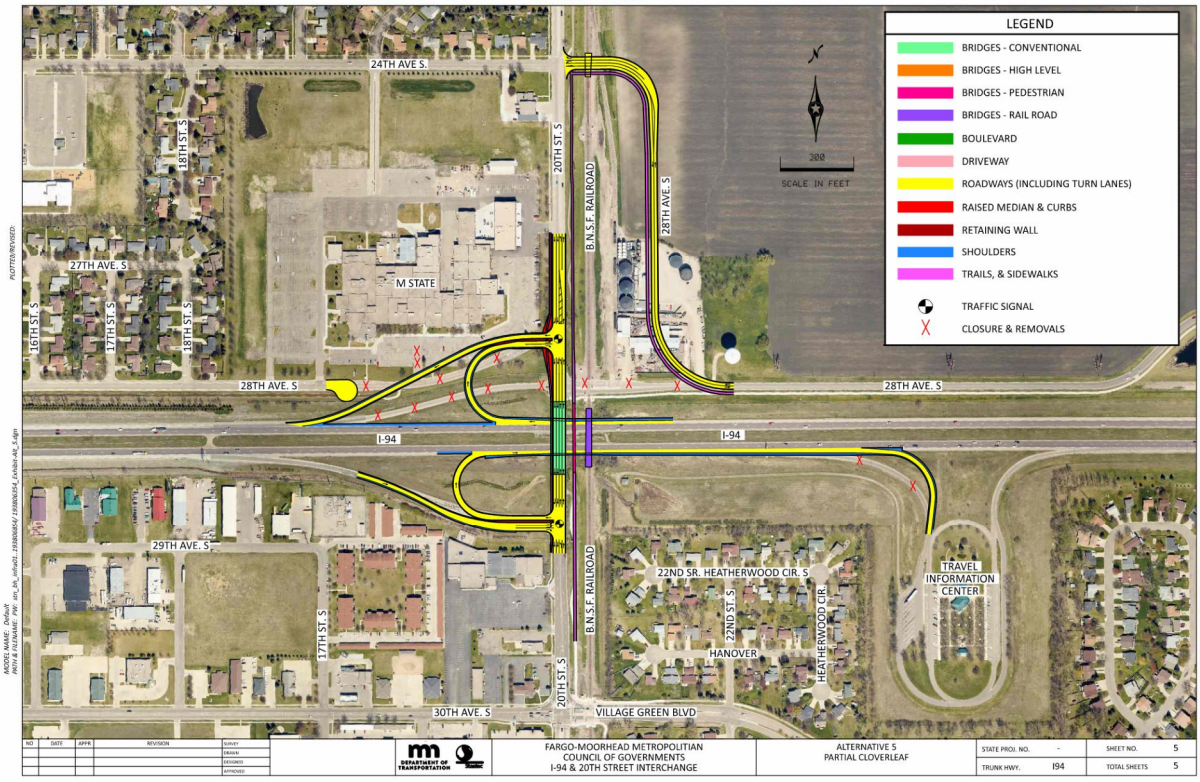


Figure 19 *Parclo*

6.4 Alternatives Screening

The alternatives above were presented and discussed during SRC Meeting #3. In, general the SRC was not in favor of the elevated alternatives (Alternatives 1, 2 and 3) due to the cost and the extent of the retaining walls. The SRC was hesitant to carry Alternative 4 forward due to its unique configuration. The Parclo (Alternative 5) was fully supported and recommended to be carried forward. Before committing to a second alternative to carry forward, the SRC asked that an additional alternative be considered. This concept included shifting the alignment of 20th Street to the west and constructing a Parclo with roundabouts for the ramp intersections rather than signalized intersections. The intent of this concept was to allow the existing 20th Street bridge to remain open during a large portion of the construction time period. The concept was developed with single lane roundabouts and appeared feasible to build without major property impacts. However, subsequent traffic analysis showed that single lane roundabouts would not handle the traffic well, and additional lanes would be required for the left turn movements. The additional lanes rendered this concept not feasible due to property and building impacts in the southwest quadrant.

During the time that the roundabout alternative was being evaluated, Anheuser Busch announced that they would be selling the malting facility and agricultural land located in the northeast quadrant. The City of Moorhead informed Metro COG that the agricultural land was anticipated to be acquired by interested developers and potentially converted to commercial properties, big box retail, and multi-family housing. Due to concern for the potential increase in traffic in the vicinity of the interchange and on 28th Avenue South, the City of Moorhead strongly recommended connectivity between 20th Street and 28th Avenue be maintained, if possible, in the two alternatives to be carried forward.

6.5 Refined Alternatives

In response to the City's recommendation, the study team revisited Alternatives 4 and 5 to determine the feasibility of maintaining access to 28th Avenue South. This analysis resulted in a new alternative and the modification of the Parclo alternative as described in the following sections.

6.5.1 Alternative 4A

Alternative 4A is modification of Alternative 4 and includes maintaining the east connection of 28th Avenue to 20th Street at the current location. To accommodate the west connection of 28th Avenue, the westbound on-ramp and 28th Avenue connection were combined in a "scissor" configuration to allow the 28th Avenue intersection to remain at its current location. This resulted in the elimination of impacts in the northwest quadrant and significantly reduced the impact to M State's parking lot. This configuration also includes left turn movements to and from west 28th Avenue as opposed to the current right-in right-out only configuration. This would address the ongoing issue of 28th Avenue traffic cutting through M State's parking lot to access northbound 20th Street and would be beneficial for transit and school bus routes. The estimated cost for this concept is $33.9 million, which includes a 30% construction contingency that the initial cost estimates did not include.

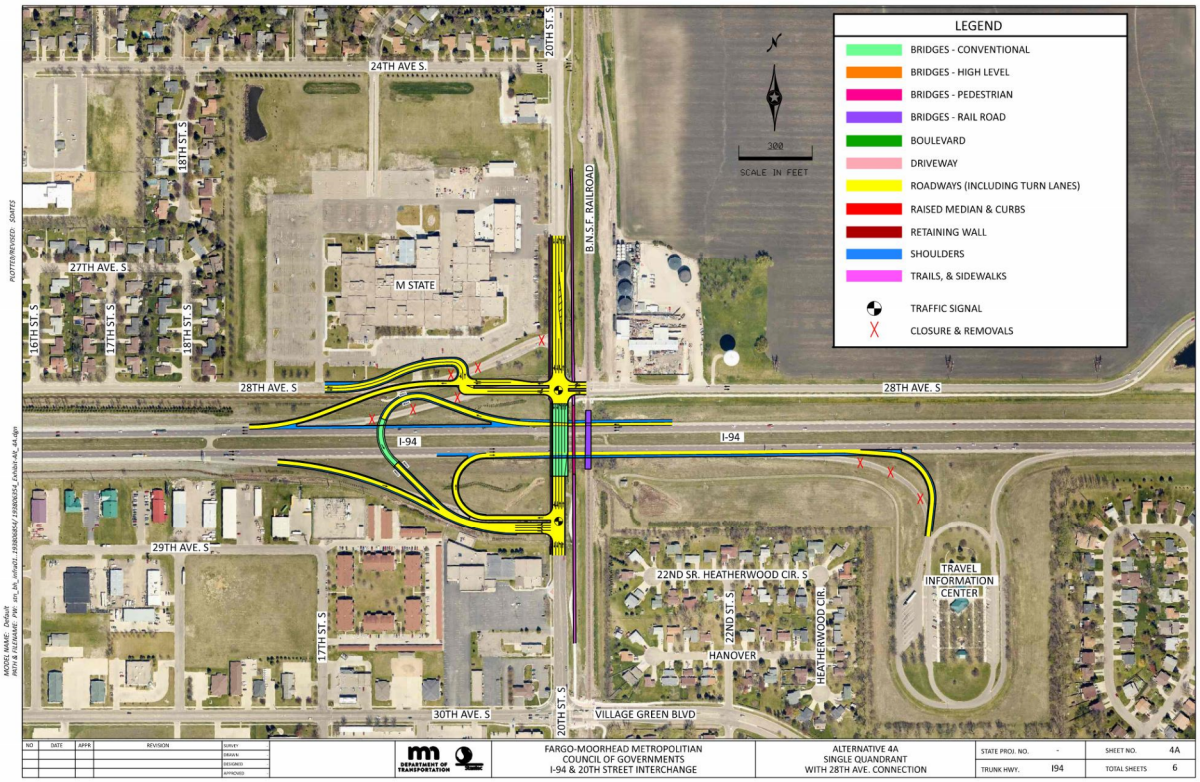


Figure 20 *Alternative 4A - Modified Single Quadrant*

6.5.2 Alternative 5 (Refined)

The interchange configuration for the refined Alternative 5 did not change. To accommodate the connection of 28th Avenue on the east side of 20th Street, the alignment of 28th Avenue was shifted north to tie into 20th Street at the intersection of 20th and the new interchange ramps. The realignment results in the need to acquire one of the two properties in the northwest quadrant. It is not feasible to provide a direct connection between west 28th Avenue and 20th Street without impacting M State's building. Therefore a "Potential Future Street Connection" was added on the west side of M State's property to provide a connection between 28th and 24th Avenues to allow 28th Avenue traffic to access 20th Street. The estimated cost is $33 million and includes allowances for the property acquisition in the northwest quadrant, relocation of the existing at grade railroad crossing of 28th Avenue, and a 30% construction contingency.

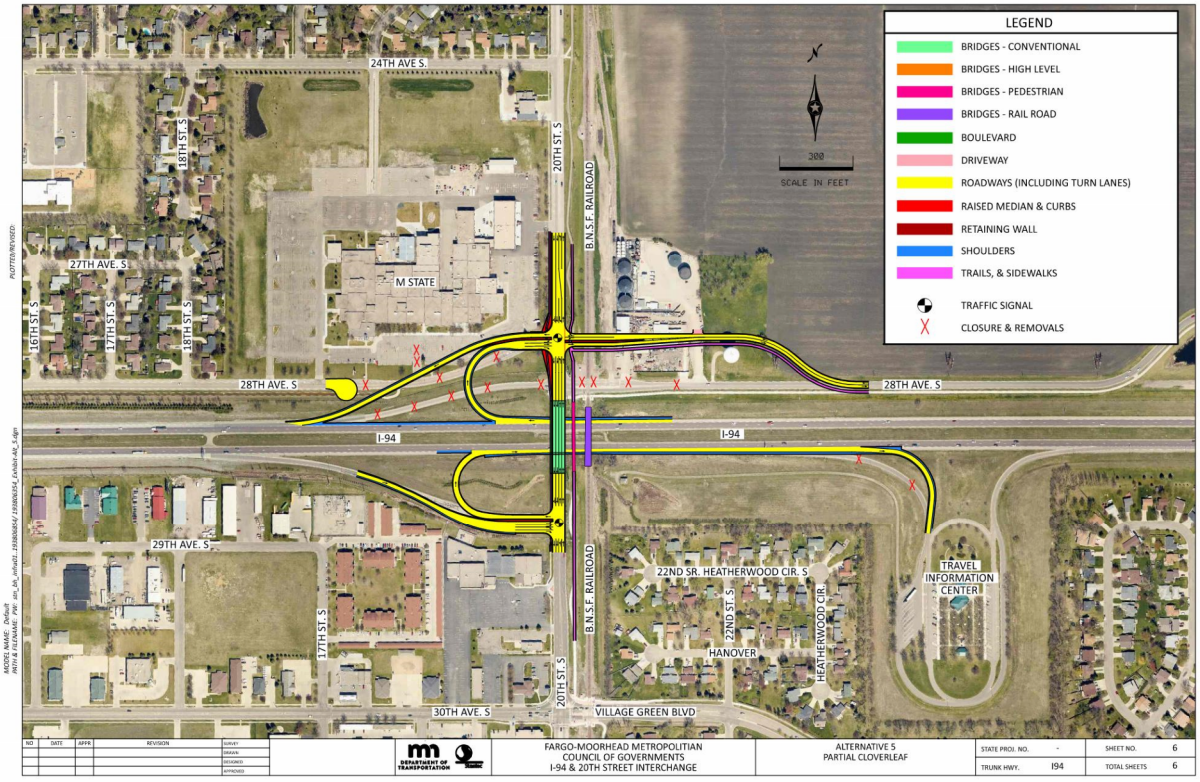


Figure 21 *Alternative 5 - Refined Parclo*

6.5.3 Traffic Analysis

During the alternatives refinement process, traffic analysis was completed for the No-Build Alternative and the two build alternatives, Alternatives 4A and 5. Both interchange concepts were found to be sufficient for the projected 2025 traffic. One of the few differences between the alternatives is that the analysis showed the need for a dedicated northbound right turn lane at 28th Avenue for Alternative 4A and not for Alternative 5. This is due to the closer proximity of the 28th Avenue intersection to the interchange for Alternative 4A.

In addition to the 20th Street Interchange, the analysis evaluated the adjacent interchanges and numerous signalized intersections in the study area. Year 2050 traffic volumes forecasts were developed for each intersection included in the study area using the Fargo-Moorhead regional travel demand model. The model accounted for future growth in the area and the impact of a full access interchange at 20th Street. The resultant forecasts indicated that some volume shift is expected to the new full interchange from the interchanges to the east and west.

Each alternative was tested and analyzed under 2050 forecast volumes which resulted in identifying the Level of Service (LOS) of movements. A summary of the LOS thresholds from the Highway Capacity Manual (HCM) is shown in **Table 7**.

Table 7 *Highway Capacity Manual Levels of Service and Control Delay*

Signalized Intersection		Unsignalized Intersection	
Level of Service	**Delay per Vehicle (sec)**	**Level of Service**	**Delay per Vehicle (sec)**
A	≤ 10	A	≤ 10
B	> 10 and ≤ 20	B	> 10 and ≤ 15
C	> 20 and ≤ 35	C	> 15 and ≤ 25
D	> 35 and ≤ 55	D	> 25 and ≤ 35
E	> 55 and ≤ 80	E	> 35 and ≤ 50
F	> 80	F	> 50

Capacity analysis for the interchange alternatives and study area intersections was performed using Synchro software and HCM 7th Edition methodology as the basis of the LOS analysis. A summary of the 2050 peak hour capacity results for each alternative is shown in Table 8.

Table 8 Level of Service Results – 2050 Forecast Year

Intersection	No Build				Alt 4				Alt 5			
	AM		PM		AM		PM		AM		PM	
	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS
8th St Intersections												
8th St at 24th Ave	29.9	C	188.4	F	30.4	C	161.9	F	30.4	C	161.9	F
8th St at WBR Ramp	28.0	C	64.4	E	27.2	C	56.6	E	27.2	C	56.6	E
8th St North Crossover	44.3	D	93.2	F	43.9	D	86.5	F	43.9	D	86.5	F
8th St at WBL Ramp	16.9	B	64.2	E	17.6	B	62.2	E	17.6	B	62.2	E
8th St at EBL Ramp	84.6	F	49.3	D	89.0	F	47.5	D	89.0	F	47.5	D
8th St South Crossover	115.7	F	54.9	D	115.7	F	59.8	E	115.7	F	59.8	E
8th St at EBR Ramp	13.6	B	41.4	D	12.9	B	39.7	D	12.9	B	39.7	D
8th St at 30th Ave	162.9	F	791.5	F	169.0	F	689.5	F	169.0	F	689.5	F
20th St Intersections												
20th St at 24th Ave[1]	34.8	C	33.5	C	6.5	A	5.4	A	16.4	B	13.1	B
I-94 WB Ramp at 28th Ave*					20.2	C	29.9	D				
20th St at 28th Ave*	12.1	B	15.4	C								
20th St at I-94 WB/28th Ave	23.0	C	33.4	C	24.4	C	19.7	B	14.8	B	33.4	C
20th St at I-94 EB Ramp	20.5	C	16.5	B	22.9	C	20.5	C	15.8	B	23.0	C
20th St at 30th Ave/Village Green Blvd	43.0	D	30.7	C	48.4	D	39.7	D	48.3	D	39.7	D
34th St Intersections												
Main Ave at 24th Ave	21.6	C	79.5	E	26.1	C	81.8	F	26.1	C	81.8	F
Main Ave at 27th Ave	9.3	A	11.8	B	13.4	B	18.1	B	13.4	B	18.1	B
Main Ave at I-94 WB On Ramp*	13.3	B	15.5	C	15.3	C	19.3	C	15.3	C	19.3	C
Main Ave at I-94 EB Off Ramp*	977.8	F	1,148.1	F	1,159.5	F	1,377.4	F	1,159.5	F	1,377.4	F
Main Ave at 34th St/Village Green	27.4	C	32.0	C	25.9	C	27.7	C	25.9	C	27.7	C
34th St at 24th Ave	26.9	C	34.2	C	25.2	C	38.0	D	25.2	C	38.0	D
34th St at 26th Ave	25.0	C	24.8	C	25.4	C	26.6	C	25.4	C	26.6	C
34th St at I-94 WB On Ramp	27.5	C	11.0	B	26.3	C	11.2	B	26.3	C	11.2	B
34th St at I-94 EB Off Ramp	26.1	C	23.3	C	26.1	C	23.9	C	26.1	C	23.9	C

*TWSC intersection, max minor approach or left turn delay

[1]Unsignalized in no-build, signalized in build

As shown in the table, the LOS results are similar under all alternatives with some variation in overall delay for some locations. Lane configurations at the new interchange were chosen to optimize intersection operations and minimize delays. Based on the traffic forecasts and operational results, the proposed conversion to a full interchange does not decrease the level of service at adjacent interchanges, and results in a decrease in delay at most study intersections. In addition a full access interchange improves access to properties between 8th and 34th Streets, and improves connectivity within Moorhead and the region.

6.5.4 Public and Agency Comment on Refined Alternatives

SRC Meeting #4

The refined alternatives were presented to the Study Review Committee on February 25, 2025. Representatives of the City of Moorhead indicated they were comfortable with presenting both alternatives at the upcoming public input meeting. They noted that one

of the main differences between the alternatives is that Alternative 4A has a direct connection of 28th Avenue and 20th Street and Alternative 5 would require a new north-south roadway on the west side of M State to provide similar connectivity. They asked that public input be solicitated on this potential connection to determine the importance to the public of providing that type of connection.

Public Input Meeting

Public Input Meeting Number 2 was held on March 11, 2025. In addition to the open house meeting, an online survey was made available to the residents. Key results from the input provided in the online survey are:

1. 75% of respondents would like interchange ramps to and from the east.
2. 62% of respondents like or are neutral about Alternative 4A (Single Quadrant)
3. 72% of respondents like or are neutral about Alternative 5 (Parclo)
4. Regarding the potential north-south connection between 28th and 24th Avenue on the west side of M State, 56% were in favor, 26% would not like to see it constructed, and 18% were unsure.

Written comments received included numerous comments in support of adding ramps to and from the east, along with comments expressing confusion on lane assignments for the existing interchange, pedestrian/bicycle accommodations, and vehicular capacity on the 20th Street Bridge.

MnDOT Comments

MnDOT's Geometric Design Support Unit provided comments on the alternatives after completing on Over-the-Shoulder review and Metro COG provided responses to their comments. Their comments included questions about traffic volumes for the new interchange ramps to and from the east, whether traffic volumes on 28th Avenue necessitated the need to maintain the type of connection shown in Alternative 4A, and a recommendation to combine the pedestrian and 20th Street bridges into one structure if that is cost effective. Specific geometric design comments included concern for how the westbound and eastbound offramp traffic merges where the ramps tie together for Alternative 4A, and concern for the modifications shown to the exit ramp at the Travel Information Center for Alternative 5. They recommended the existing ramp geometry be maintained and that additional modeling be performed to determine the best solution for merging the traffic entering I-94 from the new ramp with traffic exiting and entering I-94 at the Travel Information Center. The comment and response document is included in Appendix J.

7 Conclusions

7.1 Alternatives

Based on the analysis conducted in this study and the feedback received from the community and stakeholders, there is need and support for expanding the 20th Street Interchange to a full interchange by adding ramps to and from the east. Alternative 4A (Single Quadrant Interchange) and Alternative 5 (Parclo Interchange) are both feasible and prudent alternatives to be carried further into the next phase of project development, along with the No-Build Alternative. Items to be considered in the next phase include:

1. Potential refinement of Alternative 4A to address MnDOT's comment regarding the merging of the westbound and eastbound off-ramps.
2. Potential refinement of Alternative 5 to address MnDOT's comment regarding the ramp configuration and merging movements at the Travel Information Center.
3. If replacement of the pedestrian bridge is needed, evaluate combining the pedestrian bridge with the 20th Street Bridge to reduce costs.
4. Consider the potential increase in traffic on the interchange, 20th Street, and 28th Avenue resulting from the development of the current agricultural land in the northeast quadrant.
5. Evaluate the need, benefits, and impacts of adding a northbound right turn lane on 20th Street at 28th Avenue for Alternative 5 (traffic analysis conducted for this study indicated it was not needed, but public and stakeholder comments deemed it a priority.)

Due to the comments received from the public, it is also suggested that in the interim, the city and MnDOT consider improving the signing and pavement marking at the interchange and on 20th Street to mitigate public concerns over lane assignments and driver confusion.

7.2 Potential Funding Sources

To assist in future planning and project development, a project-specific funding matrix (based on current known programs) was developed. The names of the funding programs are listed below, and a detailed description of the programs can be found in

Appendix H. There are ten potential funding sources in the matrix and include both federal and state funding programs. The names of six of the ten funding sources are in bold text which indicates the funds can be used for preliminary engineering activities, such as those that would be undertaken in the next phase of project development.

- **Better Utilizing Investments to Leverage Development (BUILD, formerly RAISE) - USDOT**
- Congressionally Directed Spending – US Congress
- **Corridors of Commerce – MnDOT**
- Greater Minnesota Business Development Public Infrastructure (BDPI) – Minnesota Department of Employment and Economic Development
- Minnesota Capital Bonding Bill – Minnesota Legislature
- **Public Works & Economic Adjustment Assistance (EAA) Programs – US Economic Development Association**
- **Rural Surface Transportation Grant – USDOT**
- **Safe Streets and Roads for All (SS4A) – USDOT**
- Transportation Economic Development Plan – MnDOT
- **Transportation Infrastructure Finance & Innovation Act (TIFIA) – FHWA**